(54) [Title of the Invention] IMAGE TRANSMISSION DEVICE

(57) [Abstract]

[Object] The present invention can improve the transmission efficiency on the image of the important range specified by an operator through more efficient coding while improving the image quality selectively in the coding.

[Structure] When an operator selects a mode of the important range specification with an operation unit 11, the system controller 12 specifies the first fixed important range to the important range specifying unit 18, and the important range specifying unit 18 transfers the information indicating the important range specification to the graphic creating unit 17. The image coding unit codes the image data within the important position of the image to improve the image quality more than the image data at the other position.

[Claims]

[Claim 1] An image transmission device comprising:

a display means for displaying a transmission image,

a setting means for displaying information indicating an important position of image on the displayed transmission image and setting the important position interactively, and

a coding means for coding the image data within the important position of the image to improve the image quality thereof more than the image data at the other position.

[Claim 2] The image transmission device according to Claim 1, comprising:

a specifying means for specifying at least one important position of the image.

[Claim 3] The image transmission device according to Claim 2, wherein

the specifying means specifies the important position of the image with a plurality of levels.

[Claim 4] The image transmission device according to Claim 2, wherein

the specifying means specifies the important position of the image on the minimum image coding block basis.

[Claim 5] The image transmission device according to Claim 1, wherein

the coding means makes smaller quantization step width of image data at the important position of the image than the quantization step width at the position other than the important position.

[Claim 6] The image transmission device according to Claim 1, wherein

the coding means makes smaller a threshold of quantization data of the image data at the important position of the image than a threshold of quantization data at the position other than the important position.

[Claim 7] The image transmission device according to Claim 1, wherein

the coding means sets a boundary value for judging (a mode of coding a difference between the previous frame and the current frame) of the image data at the important position of the image and (a mode of coding the original image of the current frame) so as to generate (a mode of coding the original image of the current frame) much more in than a boundary value at the position other than the important position.

[Claim 8] The image transmission device according to Claim 1, wherein

the coding means makes generation cycle of a compulsory (mode of coding the original image of the current frame) of the image data at the important position of the image shorter than the generation cycle at the position other than the important position.

[Claim 9] The image transmission device according to Claim 1, comprising:

a means for maintaining the already-registered important range effective even when a display of the important position of the image turns off.

[Detailed Description of the Invention]

[0001]

[Industrial Field] The invention relates to an image transmission device and more particularly to an image transmission device of transmitting and receiving images and sounds through a digital communication line.

[0002]

[Related Art] The conventional analog telephone line could transmit nothing but the sound and transmit the data at lower speed.

[0003] Recently, with progress in the communication technology, semiconductor technology, and optical technology, the digital lines are fully prepared and data of large capacity can be transferred at high speed.

[0004] As the characteristic of digital transfer, after being transferred, data can be kept well at the same quality without deterioration and media can be integrated easily, without requiring each transmission channel depending on the characteristic of the media of transfer data, which enables the transfer between mixed media terminals. According to this, there appears a telephone terminal which simultaneously transmits images in addition to the sound conventionally transmitted.

[0005] Under this situation, international standardization is progressing in CCITT so as to enable mutual communication between different multimedia terminals, and service regulations for AV (Audio Visual) service, protocol regulations, definition of

multimedia multiplex frame structure as the AV service such as TV phone and TV conference system using a digital line, are disclosed in CCITT Recommendation (or draft) H.320, H.242, H.221, and the like.

[0006] The H.221 defines the frame structure in the AV service from 64 Kbps to 1920 Kbps, exchange of terminal ability, and code assignment of FAS (Frame Alignment Signal) and BAS (Bit Allocation Signal) in a communication mode.

[0007] The H.242 defines the protocols of ability exchange between AV terminals using BAS and switching of communication mode, and the H320 defines the system aspect of the whole AV service.

[0008] In the above Recommendation (or Recommendation Draft), there is defined a method of performing a multimedia communication such as images, sounds, and data between terminals according to the procedure such as an exchange sequence of terminal ability using In-channel BAS and a mode switching sequence by specification of communication mode, after establishing a physical connection of end-to-end and a synchronization by AFS in the In-channel.

[0009] However, it is out of the definition that the terminal ability of each terminal is changed depending on the situation and which communication mode is used within the range of the exchanged ability.

[0010] With respect to the information transfer speed of each media in the multimedia communication, that speed of the sound information is determined by specifying a sound coding method,

while that of the data information is determined in accordance with whether it is used or not and by the transfer speed specified when it is used, and the remain obtained by subtracting the transfer speed of the sound information and the transfer speed of the data information from the information transfer speed of the entirely set communication channel becomes the transfer speed of the image information.

[0011]

[Problems to be Solved by the Invention] According to the conventional TV phone, however, in the case of the current coding method, characteristic of an image within every block is examined and a method of coding control depending on the characteristic is performed. Alternatively, a coding control assuming the conference scene including background and person to some degree is performed; that is, on the assumption that a person stands in the middle with the background therearound.

[0012] In the former case, since just the characteristic of the image within a block is judged, it becomes a microscopic view of image and therefore it is difficult to judge whether the image of the block is important on the whole screen or not. Especially, when it tries to restrict the volume of the data for one frame to some value, since it tries to restrain the image data amount uniformly assuming that importance is uniform on the whole screen, the coding control is uniformly performed in each block, hence to disturb the improvement in quality of the really important image.

[0013] In the latter case, when it meets a condition under the fixed condition, efficient coding is possible, but when it does not meet the condition, the coding control hampers the efficient performance, hence to reduce the efficiency. Since the above condition does not reflect on an operator's will, it does not satisfy the operator's request.

[0014] An object of the invention is to provide an image transmitting device which resolves the above problem.

[0015]

[Means for Solving the Problems] The invention is characterized by comprising a display means for displaying a transmission image, a setting means for displaying information indicating an important position of image on the displayed transmission image and setting the important position interactively, and a coding means for coding the image data within the important position of the image to improve the image quality thereof more than the image data at the other position.

[0016] Further, the invention is characterized by comprising a specifying means for specifying at least one important position of the image.

[0017] Further, preferably, it is characterized in that the specifying means specifies the important position of the image with a plurality of levels.

[0018] Further, preferably, it is characterized in that the specifying means specifies the important position of the image on the minimum image coding block basis.

[0019] Further, preferably, it is characterized in that the coding means makes smaller quantization step width of image data at the important position of the image than the quantization step width at the position other than the important position.

[0020] Further, preferably, it is characterized in that the coding means makes smaller a threshold of quantization data of the image data at the important position of the image than a threshold of quantization data of the image data at the position other than the important position.

[0021] Further, preferably, it is characterized in that the coding means sets a boundary value for judging (a mode of coding a difference between the previous frame and the current frame) of the image data at the important position of the image and (a mode of coding the original image of the current frame) so as to generate (a mode of coding the original image of the current frame) much more in than a boundary value at the position other than the important position.

[0022] Further, preferably, it is characterized in that the coding means makes generation cycle of a compulsory (mode of coding the original image of the current frame) of the image data at the important position of the image shorter than the generation cycle at the other position than the important position.

[0023] Further, preferably, it is characterized by comprising a means for maintaining the already-registered important range effective even when a display of the important position of the image turns off.

[0024] It is possible to improve the transmission efficiency through the efficient coding processing while improving the image quality on the image of the important range specified by an operator selectively in the coding.

[0025]

[Embodiment] Hereinafter, an embodiment of the invention will be described with reference to the drawings.

[0026] Fig. 1 is a block diagram of the structure of a TV phone according to one embodiment of the invention. In Fig. 1, the reference numeral 1 designates a handset that is one of the sound input and output means of this device; the reference numeral 2 designates a microphone that is one of the sound input means of the device; the reference numeral 3 designates a speaker that is one of the sound output means of the device; the reference numeral 4 designates a sound interface (i/f) which has a function of switching the handset 1, the microphone 2, and the speaker 3 as the sound input and output means according to an instruction of a system controller 12, a gain adjustment function for adjusting sound level, an on/off detection function for detecting whether the handset 1 is in an on-hook state or off-hook state, an echo cancel function for cancelling echo when the microphone 2 and the speaker 3 are used as the sound input and output means, and a tone creating function such as dial tone, call tone, busy tone, and incoming call sound; and the reference numeral 5 designates a sound coding and decoding unit which has a function of A/D converting and coding the transmission sound signals according to the sound coding/decoding algorithm such as 64 kbps

PCM (A-law), 64 kbps ADPCM (μ-law), 7 kHz audio (SB-ADPCM), 32 kbps PCM, 16 kbps (for example, APC-AB) 8 kbps, and a function of decoding the received sound signals and D/A converting them, according to the instruction of the system controller 12.

[0027] The reference numeral 6 designates a camera included as standard equipment which picks up a person; the reference numeral 7 designates a graphic camera, which is one of the image input means of the device, for entering a painting and a drawing; the reference numeral 8 designates a display which displays an input image from the camera 6 or the graphic camera 7, a received image from the other party, and an image from the system controller 12; the reference numeral 9 designates an image input and output unit having a switching function of the image input means, a display switching and display dividing function of the above images, and a signal conversion function for gaining a match in an electric way of signal with the video signal of each image input and output unit, according to the instruction of the system controller 12; the reference numeral 10 designates an image coding and decoding unit having a function of A/D converting the transmission images and coding them and a function of decoding the received images and D/A converting them, which performs bandwidth compression on the row data of an image of large volume according to various methods including motion compensation, frame dropping, and frame interpolation and including frame interpolation, DCT, and vector quantization, to reduce the data in volume so as to be able to transfer it in the digital line. Though the basic interface of the ISDN line is 64 kbps, there

is the CCITT Recommendation Draft H, 261 as the coding method of images capable of transferring even at this transfer speed.

[0028] The reference numeral 11 designates an operation unit such as a keyboard and a touch panel used for entering control information for controlling this device; the reference numeral 12 designates a system controller including CPU, ROM, RAM, auxiliary storage, character generator, and an image signal creating circuit, which controls the whole system while monitoring the state of each unit, creates an operation/display screen according to the situation, and executes an application program; the reference numeral 13 designates a multiplex-demultiplexer which multiplexes the sound data from the sound coding and decoding unit 5, the image data from the video coding and decoding unit 10, and BAS from the system controller 12 on the transmission frame basis and which separates the received frames into each media on the component basis to be informed to each unit, and as the CCITT Recommendation, there is H.221.

[0029] The reference numeral 14 designates a line interface which controls the line according to the ISDN user network interface. The reference numeral 15 designates an accumulator which records and stores data from the sound i/f 4 and the image input and output unit 9 and reproduces the stored data depending on necessity; the reference numeral 16 designates an image composite unit which combines an image b from the image decoding unit, an image a from the image input unit, and a graphic image c from the graphic creating unit 17 with each other, according

to a control signal d from the system controller 12 and transfers the above to the image output unit. The graphic creating unit 17 creates graphic data from the CG and bitmap created in the system controller 12. The reference numeral 18 designates an important range specifying unit which stores an important position of an image according to the information from the system controller 12 and specifies the important position in the graphic creating unit 17 and the image coding unit; and the reference numeral 19 designates a storage unit which stores the format and the like of the transmission screen to be transferred to the graphic creating unit 17, the range of the specified important point, and the processing method to manage the above, which is included within the system controller 12.

[0030] This time, the operation will be described. When an operator selects the mode of the important range specification through the operation unit 11, the system controller 12 gives the important range fixed at first to the important range specifying unit 18, and the important range specifying unit 18 sends the information for indicating the above important range specification to the graphic creating unit 17. The information is, for example, the information of the coordinate position of the important range on the display screen and the information about the display method of the important position.

[0031] The graphic creating unit 17 creates a display position of graphic data and the image information of the graphic data to be displayed on the screen based on the above-mentioned information and transfers the above to the image composite unit

16. This image information is the index information of a table (color look-up table) in which simultaneously displayable color information is selected from the displayable colors not the actually displayed color information and registered.

[0032] The internal structure of the image composite unit 16 is shown in Fig. 2.

[0033] The reference numeral 20 designates a transmitting video RAM which receives and stores the transmission images from the image input unit; the reference numeral 21 designates a receiving video RAM which receives and stores the received image from the image decoding unit; the reference numeral 22 designates a color look-up table for converting the index information transferred from the graphic creating unit 17 into the color information of the image data; the reference numeral 23 designates a video synchronization generating unit which generates a horizontally synchronous and vertically synchronous signal that is the output timing of the image data from the transmitting video RAM 20, the receiving video RAM 21, and the color look-up table 22; the reference numeral 24 designates an image scaling unit which scales up and down the image data supplied from the transmitting video RAM 20 into a desired size according to an instruction from the system controller 12; and the reference numeral 25 designates an image scaling unit which scales up and down the image data supplied from the receiving video RAM 21 into a desired size according to an instruction from the system controller 12.

[0034] The reference numeral 26 designates an SW controller which monitors the image data supplied from the color look-up

table 22, based on the image data for switching instruction of the video switch (SW) 27 directed by the system controller 12, in every pixel position on the screen of the display 8 (at every display timing); when the image data is that one for monitoring the image data from the transmitting video RAM 20 and selecting the image data from the transmitting video RAM 20, it controls the SW 27 to select the image data from the transmitting video RAM 20 and output the same; while when the image data is that one for selecting the image data from the receiving video RAM 21, it controls the SW 27 to select the image data from the receiving video RAM 21 and output the same; in the case of the other image data, it controls so as to select the image data supplied from the color look-up table 22 and output the same. The SW 27 selects one of the respective image data according to the SW control and outputs it to the image output unit.

[0035] The image composite unit 16 can display the graphic data from the color look-up table 22 on the full screen and display the transmitting image data from the transmitting video RAM 20 and the receiving image data from the receiving video RAM 21 on the screen. The transmitting image data may have the graphic data from the color look-up table displayed over the receiving image data in a superimposing way. Further, when the transmitting image data overlaps with the receiving image data, one of the overlapped images may be selected and displayed.

[0036] Next, the internal structure of the image coding unit within the image coding and decoding unit 10 is shown in Fig. 3.

[0037] The reference numeral 28 designates a coding controller which controls each unit according to the judgment which is made according to an instruction from the system controller, of all the controllers, and creates necessary information; the reference numeral 29 designates an important MB register which takes in the important position information from the important range specifying unit 18 and registers the MB of the important position and the prioritized coding control on the important position; the reference numeral 30 designates a frame dropping controller which restrains the code amount by thinning out the image frames targeted for coding; the reference numeral 31 designates an INTER/INTRA judging unit which judges INTER (difference between the previous frame image and the current frame image)/INTRA (original image value of the current frame) on the same MBs in the previous frame and the current frame after calculating the average square error between the frames and the dispersion within the frame; the reference numeral 32 designates an MC judging unit which judges whether or not the block of the current target frame has a pattern matching through searching the range including the previous frame, that is, whether or not the motion compensation is performed; the reference numeral 33 designates an MC controller which controls the MC by specifying the presence/absence of the motion compensation and the motion vector (direction and size) according to the judgment result of the MC judging unit 32; and the reference numeral 34 designates an INTER/INTRA controller which instructs the INTER/INTRA

control to each unit according to the judgment result of the INTER/INTRA judging unit 31.

[0038] The reference numeral 35 designates a filter controller which instructs the filtering after the motion compensation; the reference numeral 36 designates a refresh cycle counter which switches to INTRA for a certain period to get refreshed, in order to cope with such a problem that quantization errors accumulate on the receiving side when the INTER continues on the same MB, or that it cannot be recovered when the decoded image is disturbed by the transfer error; the reference numeral 37 designates a quantization threshold controller which controls the threshold so as to improve the data generation efficiency when it is quantized and controls the data less than a predetermined value to be zero so as not to generate any data; the reference numeral 38 designates a quantization step size controller which controls the quantization step size according to the accumulated data amount in a transmitting buffer 49; the reference numeral 39 designates a transmitting amount detector which detects the accumulated amount of the transmitting buffer 49; the reference numeral 40 designates a header information creating unit which creates a frame header, a GOB header, and an MB header; the reference numeral 41 designates a frame memory; the reference numerals 42 and 43 designate a switch which selects INTER/INTRA; and the reference numeral 44 designates a subtractor which performs subtraction between the previous frame and the current frame in the case of INTER.

[0039] The reference numeral 45 designates a DCT unit (irreversible coding) which converts the signals from space region to frequency region through the orthogonal transformation; the reference numeral 46 designates a quantizer; the reference numeral 47 designates a VLC unit (reversible coding) which performs the variable-length coding on the generated data; the reference numeral 48 designates a multiplexer; the reference numeral 49 designates the transmitting buffer; the reference numeral 50 designates a BCH unit which generates an error correction frame; the reference numeral 51 designates an inverse quantizer; the reference numeral 52 designates an inverse DCT unit; the reference numeral 53 designates an adder which adds the previous frame to the current frame; the reference numerals 54 and 55 designate switches for alternatively switching between the reading frame and the writing frame; the reference numerals 56 and 57 designate frame memories; the reference numeral 58 designates an FM controller which controls the switches 54 and 55 and the frame memories 56 and 57; the reference numeral 59 designates a motion compensation unit which detects a pattern matching with the current frame while searching for the previous frame; the reference numerals 60 and 61 designate switches for selecting ON/OFF of a filter; the reference numeral 62 designates the filter; and the reference numeral 63 designates a switch for turning ON/OFF the data input to the FIFO (memory)64.

[0040] The structure of the image to be coded is shown in Fig. 4.

[0041] Since there are a plurality of standards including NTSC, PAL, and digital TV standard with respect to the handling video signals, in the H.261 Recommendation Draft, a universal video signal format is adopted so as to be able to establish a mutual communication.

[0042] This format is referred to as CIF format with the luminance Y defined as the sample number 352 pixels × 288 lines and the color difference Cr and Cb defined as the sample number 176 pixels × 144 lines.

[0043] The sample point (sampling point) is defined as a point located equally from the four points of luminance (Y1, Y2, Y3, Y4) with respect to the color difference (Cr, Cb).

[0044] One fourth of the CIF is referred to as QCIF format, with the luminance Y defined as the sample number 176 pixels × 144 lines and the color difference Cr and Cb defined as the sample number 88 pixels × 72 lines.

[0045] The above format is formed by a plurality of GOB formats, the GOB format is formed by 33 MB formats, further the MB format is formed by four blocks Y1, Y2, Y3, and Y4 each including the luminance block 8 pixels × 8 lines and two blocks Cr and Cb each including the color difference block of 8 pixels × 8 lines, in a hierarchical structure.

[0046] This hierarchical structure enables coding by the unit of MB.

[0047] The GOB is defined with the luminance defined as the sample number 176 pixels × 48 lines and the color difference Cr and Cb defined as the sample number 88 pixels × 24 lines,

it corresponds to 1/12 of the CIF and 1/3 of the QCIF, and the GOB number for the CIF is assigned like GOB1 to GOB12 and the GOB number for the QCIF is assigned like GOB1, GOB3, and GOB5.

[0048] The frame structure of the coded image data is a multiplexing frame structure as shown in Fig. 5. For convenience of explanation, a description will be made with FH attached.

[0049] Fig. 5(a) shows the structure of the GOB block. As illustrated, FH is attached at the head of the data for one frame on a screen, and the screen is divided into 12 blocks of GOB; GOB1 to GOB12, where data is transferred sequentially.

[0050] The dividing method of the GOB is shown in Fig. 5(b). Fig. 5(b) shows the detailed contents of the FH and the GOB in (a). The FH consists of PSC, TR, and PTYPE. The PSC is the frame starting symbol and it is "0000 0000 0000 0001 0000" of 20 bits. The TR is the frame number and a value of 5 bits from "1" to "30" is used for it. The PTYPE is the type information of 6 bits, including split/screen instruction information, painting/drawing camera instruction information, screen unfreezing, and information-source format instruction information (CIF and QCIF). Namely, an FH decoder notifies the decoding result of the above contents to the controller 28.

[0051] The GOB header is formed by GBSC, GN, and GQUANT. The GBSC is the GOB starting symbol and it is "0000 0000 0000 0001" of 16 bits. The GN is the GOB number, using "1" to "12" for 4 bits. When the GN is "0", since it is used in PSC, it can be regarded that the PSC of the FH and the GBSC+GN of the GOB are both the sequential values for 20 bits. The GQUANT is the

quantization attribute information, including the information of quantization step size for 5 bits.

[0052] The MB header is the header of a pixel block referred to as a macro block (hereinafter, referred to as MB).

[0053] As mentioned above, 33 MBs form one GOB and the IMB is formed by four luminance signals (Y) of 8 pixels × 8 lines and two color difference signals (Cb and Cr) of 8 pixels × 8 lines. As the number of each block, the numbers 1 to 4 are assigned to Ys, 5 is assigned to Cb, and 6 is assigned to Cr. This MB header consists of MBA, MTYPE, MQUANT, MVD, and CBP.

[0054] The MBA is the macro block address indicating the position of the MB, only the head MB is the absolute value and the later MBs are differential variable length codes. The MTYPE is the type information of MB, in which the processing type performed on the MB data is inserted such as INTRA (intra-frame coding), INTER (inter-frame differential coding), MC (motion compensated inter-frame differential coding), and FIL (filter). The MQUANT is the same as the GQUANT. The MVD is the motion vector information. The CBP includes the four Ys of the MB in a significant block pattern and the effective pixel block number of Cr and Cb as the information. As mentioned above, the pixel blocks that get the significant blocks of the compressed and coded image data of the four Ys and Cr and Cb are arranged in the numerical order after this MB header.

[0055] The data to be supplied to the line is the error correction frame of the format as shown in Fig. 6. One frame consists of the sum of 512 bits including 1 bit of error correction frame,

1 bit of fill identifier, 492 bits of pixel data, and 18 bits of error correction parity. Further, these eight frames form one multi-frame.

[0056] The compression method of the image is recommended by the H.261 Recommendation in CCITT and when it conforms to the Recommendation, it can communicate mutually with a TV phone which is compliant with another recommendation.

[0057] For easy description of the coding method, at first, hybrid is created by a plurality of compression techniques including: intra-frame coding of performing the two dimensional DCT on the data within frame in every block of 8 pixels × 8 pixels, using that correlation between the pixels is strong in the video of the natural world and that the frequency component centers on the low frequency and not so much on the high frequency; inter-frame coding of taking a difference between frames when the previous frame and the current frame have a strong correlation in the image block at the same position and performing the two dimensional DCT on the differential value in every block of 8 pixels × 8 pixels; motion compensation of detecting the movement when the similar image block relatively moves adjacently from the previous frame to the current frame and just transmitting the shift amount of the image block and the information of the shift direction without transmitting the image data itself, hence to decrease the data generation amount; zero-run-length coding which uses that a coefficient value is generated in the low frequency region but that it is hardly generated in the high frequency region, with a series of zero, in every frequency after

the DCT; quantization of adjusting the data generation amount by changing the quantization step width of the data according to the data generation amount; variable-length coding of converting the data into data amount less than the data amount totally generated by assigning a short code value to the data pattern of high generation frequency and a long code value to the data pattern of low generation frequency; and frame thinning-out of skipping a frame to thin out the image data itself, which makes it possible to transfer a moving image even in a low-rate communication.

[0058] Next, the important range specifying method will be described and as illustrated in Fig. 7, an important range is specified by the unit of MB. The region indicated by the rough dots in Fig. 7 indicates the second priority and the region indicated by the slash indicates the first priority.

[0059] A frame surrounding this region is transferred from the important range specifying unit 18 in Fig. 1 to the graphic creating unit 17, the graphic creating unit 17 transfers this frame information to the image composite unit 16, the image composite unit 16 combines the above frame information with the self image of video signal a from the camera and transfers the same to the image output unit, and the image output unit displays it on the display 8, hence to notify an operator of the important range. The concrete image on the display screen is shown in Fig. 8.

[0060] Fig. 8(a) shows the image of the other party in a full screen and the self image in a sub screen and (b) shows the enlarged

self image. Fig. 8(b) shows the frame indicating the important range. This frame indicates the important range.

[0061] Fig. 8(c) is an example in the case of specifying a plurality of important positions. When a plurality of objects are to be shot, a plurality of important ranges are specified to be mainly coded, thereby enhancing the coding efficacy. Fig. 8(d) shows the case of specifying an important range at a plurality of levels. By prioritizing the inner frame than the outer frame, minuter and finer coding is possible.

[0062] Fig. 9 shows the MB control management table. This MB control management table is a table for managing how to control the coding on each MB.

[0063] The specifying method of MB number is managed by GOB number, START MB number, and END MB number. The START MB number is the MB number where the important position within the GOB number starts and the END MB number is the MB number where the important position within the GOB number starts. The MBs between the START MB number and the END MB number become the MBs of the important range. In the case of specification of a plurality of ranges and specification of a plurality of levels, there are specified a plurality of START MB numbers and END MB numbers within the same GOB number.

[0064] Thus determined MBs have the INTER/INTRA judgment standard, quantization threshold standard, quantization step size standard, and refresh cycle standard defined depending on each importance level and they are controlled according to each

control standard. An MB having no importance level is judged as an ordinal MB.

[0065] The management table in Fig. 9 is an example created based on the important position specification in Fig. 7. The INTER/INTRA judgment standard is shown in Fig. 10. Fig. 10(a) shows the INTER/INTRA judgment standard in the general case. The vertical axis shows the dispersion of the difference within the block (B) of the current frame of the target MB, which is defined by the following formula.

[0066]

[Mathematical Formula 1] $f\text{-}dif = \sum B^2 /256 - (\sum B/256)^2$

The horizontal axis shows an average square error of difference between the motion compensated block (MCB) of the previous frame and the block (B) of the current frame as for the target MB, which is defined by the following formula.

[0067]

[Mathematical Formula 2]

$mc\text{-}dif = \sum |B\text{-}MCB|^2 /256$

As the judgment standard, when the mc-dif is smaller than a certain value, it is judged absolutely as the INTER mode, when f-dif $\geq$ mc-dif, it is judged as the INTER, and when f-dif $<$ mc-dif, it is judged as the INTRA.

[0068] Fig. 10(b) shows the judgment standard in the case where by setting smaller the value of mc-dif which is absolutely judged as the INTER mode, it is judged as the INTER when f-dif $\geq$ mc-dif even when the mc-dif is smaller and it is judged as the INTRA when f-dif $<$ mc-dif, hence to increase the generation probability

of the INTRA more than usual. This can eliminate quantization errors at the receiving side in a state of less data generation amount by judging it as the INTRA when difference within frame is small.

[0069] Fig. 10(c) shows the INTER/INTRA judgment standard in the case where by making the inclination of the boundary between the INTER and the INTRA larger than usual, it is judged as the INTRA more often than usual, in the region surrounded by the dotted line and the solid line, namely, as much for the increase of the inclination. It is judged as the INTRA for the above increase rate and the quantization error at the receiving side can be eliminated for the generation probability, hence to improve the image quality. Especially, according as the mc-dif becomes larger, the generation probability of the INTRA increases, hence to reduce the cumulative quantization error when the difference is large.

[0070] Fig. 10(d) shows the INTER/INTRA judgment standard in the case where INTRA is generated in the deviated region of the boundary by shifting the boundary between the INTER/INTRA parallel toward the smaller value of the mc-dif than usual. Since the threshold value of the boundary between INTER and INTRA is shifted toward the higher value of the f-dif for a predetermined value, INTRA is generated by the sifted value and the probability of judging as INTRA is surely increased regardless of the value of the mc-dif.

[0071] The quantization error at the receiving side can be restrained as much as possible by generating more INTRA than

usual and deterioration of the image quality caused by the decoding error can be refreshed as soon as possible.

[0072] The quantization threshold standard in Fig. 9 shows the maximum value of variable threshold control for generating this coefficient 0 as sequentially as possible in the case where the zero-run length coding is performed on the coefficient value 0 after the quantization, hence to restrain the data generation amount. Since it is the magnifying power as for the set quantization step size, the value obtained by multiplying the quantization step size by this magnifying power becomes the maximum value of the quantization threshold. Usually, it is set at twice and by increasing the threshold, much more coefficients 0 are generated. By decreasing the quantization threshold, the coefficient which is generally rounded to zero comes to have a value, which enables transfer of more detailed coefficient, hence to improve the reproducibility of image at the decoding time.

[0073] Next, with respect to the quantization step size in Fig. 9, when no special image block such as the important image exists, the same quantization processing is usually performed on each image block, as illustrated in Fig. 11(a).

[0074] The vertical axis in Fig. 11 shows the quantization step size. The value ranges from 2 to 62. The horizontal axis shows the sufficient degree of the transmission buffer. The buffer sufficient degree means the value obtained by accumulating an increase and decrease of difference between the actually generated data amount and the data generation amount to be

expected when it is averagely assigned to each block based on the data amount because the data generation amount of frame is determined (in the H.261 Recommendation, QCIF is defined as 64 kbit and CIF is defined as 256 kbit).

[0075] Fig. 11(a) shows the case where the quantization step size changes linearly as for the sufficient degree. According to an increase in the data generation amount and the sufficient degree, the quantization step size is increased, hence to restrain the data generation amount. On the contrary, according to a decrease in the data generation amount and the sufficient degree, the quantization step size is decreased, hence to improve the image quality.

[0076] Fig. 11(b) shows the case in which the quantization step size processing is divided between the usual image block and the image block of the important position; in the case of the usual image block, the quantization step size is increased, while in the case of the image block of the important position, the quantization step size is decreased, at the same transmission buffer sufficient degree, hence to assign much more data to the image block of the important position.

[0077] Fig. 11(c) shows the case where there are a plurality of importance levels and the importance level 1 is above the importance level 2. Since the quantization step size reaches the maximum before the transmission buffer sufficient degree gets full, it possibly can be quite rough image.

[0078] Fig. 11(d) is an example in the case where a difference of the image quality between the usual block and the important

position is exaggerated. Compared with (c), the difference is larger, and the image quality of the important position can be much improved than that of (c). Fig. 11(c) is used in the example of Fig. 9.

[0079] Since the refresh cycle standard in Fig. 9 is not improved just by the transfer of differential value in the INTER mode, because of the quantization error at the receiving side and the error of the receiving data, the images are refreshed by transmitting the original image (INTRA) to the other terminal within the maximum times 132. Then, the refresh cycle standard is prioritized by making the important position shorter than the usual time (namely, the maximum number of refresh times is decreased). In the example, the maximum number is 66 at the importance level 1 and 110 at the importance level 2.

[0080] The above processing in Fig. 9 is referred to in every processing of each macro block, the quality of the macro block at the important position is improved than the usual macro block. Thus, an operator can specify an important position while watching at the monitor and automatically perform a control in the specified important position with the image quality improved more than the usual position.

[0081] Although the above description has been made taking the TV phone for example, the invention is not restricted to this but it can be variously adopted to something that transfers moving images.

[0082]

[EFFECT OF THE INVENTION] As set forth hereinabove, according to the invention, it is possible to improve the image quality of the important position in the image transmitted to the other terminal while watching a display screen.

[0083] According to the above, since an operator can preferentially assign the image coded data to the image region specified by the important range, a correct and proper coding control is performed and the coding efficiency is drastically improved while improving the image quality. It can surely improve the image quality while the operator's watching the image depending on his or her desire, hence to improve the operator's convenience.

[BRIEF DESCRIPTION OF DRAWINGS]

[Fig. 1] Fig. 1 is a block diagram showing one example of the invention.

[Fig. 2] Fig. 2 is a view of the internal structure of the image composite unit.

[Fig. 3] Fig. 3 is a view of the internal structure of the image coding unit.

[Fig. 4] Fig. 4 is a view showing the image format.

[Fig. 5] Fig. 5 is a view showing the image data multiplex frame.

[Fig. 6] Fig. 6 is a view showing the error correction frame synchronization.

[Fig. 7] Fig. 7 is a view showing the important position specification.

[Fig. 8] Fig. 8 is a view showing the important image specification display example.

[Fig. 9] Fig. 9 is a view showing the MB management table.

[Fig. 10] Fig. 10 is a view for use in describing the INTER/INTRA judgment control.

[Fig. 11] Fig. 11 is a view for use in describing the quantization step size control.

[Description of Reference Numerals and Signs]

1 Handset

2 Microphone

3 Speaker

4 Sound i/f

5 Sound coding and decoding unit

6 Camera

7 Graphic camera

8 Display

9 Image input and output unit

10 Image coding and decoding unit

11 Operation unit

12 System controller

13 Multiplexer-demultiplexer

14 Line i/f

15 Accumulator

16 Image composite unit

17 Graphic creating unit

18 Important range specifying unit

19 Storage unit

Fig. 1

1: Handset

2: Microphone

3: Speaker

4: Sound i/f

5: Sound coding unit/Sound decoding unit

6: Camera

7: Graphic camera

8: Display

9: Image input unit/Image output unit

10: Image coding unit/Image decoding unit

11: Operation unit

12: System controller

13: Multiplexer-demultiplexer

14: Line i/f

15: Accumulator

16: Image composite unit

17: Graphic creating unit

18: Important range specification

19: Storage unit

Fig. 2

画像出力：Image output

a：Transmission image

b：Received image

c：Control signal

d：Graphic data

20: Transmitting video RAM

21: Receiving video RAM

22: Color look-up table

23: Video synchronization generating unit

24: Image scaling unit

25: Image scaling unit

26: SW controller

Fig. 3

28: Coding controller

29: Important MB register

30: Frame dropping controller

31: INTER/INTRA judging unit

32: MC judging unit

33: MC controller

34: INTER/INTRA controller

35: FILTER controller

36: Refresh cycle counter

37: Quantization threshold controller

38: Quantization step size controller

39: Transmitting amount detector

40: Header information creating unit

58: FM controller

59: Motion compensation unit

前処理：Preprocessing

回線：Line

Fig. 4

CIF format

QCIF format

GOB format

MB format

サンプリング点：Sampling point

ブロックフォーマト：Block format

Fig. 5

フレームヘッダ：Frame header

GOB header

MB header

係数データ：Coefficient data

MB header

Fig. 6

誤り訂正パリティ：Error correction parity

誤り訂正フレーム：Error correction frame

When Fi:"1", image data, when "0", fill bit (null data) fill identifier

Fig. 7

CIF format

QCIF format

Fig. 8

相手画像：Image of the other party

自画像：Self image

Frame indicating the important range

Frame indicating the important range

Frame indicating the important range

Fig. 9

上記以外：Other than the above

その他：The others

The others

INTER/INTRA judgment standard

量子化しきい値基準：Quantization threshold standard

量子化ステップ基準：Quantization step size standard

リフレッシュ周期基準：Refresh cycle standard

重点レベル：Importance level

Fig. 10(c)

Fig. 10(d)

Fig. 10(c)

Fig. 10(a)

1.5倍：1.5 times

1.2 times

1.5 times

2倍：Twice

図１１（ｃ）レベル２：Fig. 11(c) level 2

Fig. 11(c) level 1

Fig. 11(c) level 2

Fig. 11(c) usual

110 times

66 times

110 times

132 times

非該当：N/A

Fig. 11

(a)

量子化ステップ：Quantization step

空：Empty

満：Full

通信バッファ充足度：Transmission buffer sufficient degree

(b)

Quantization step

Transmission buffer sufficient degree

Empty

Full

通常：Usual

重点：Important

(c)

Quantization step

Transmission buffer sufficient degree

Empty

Full

Usual

Importance level 2

Importance level 1

(d)

Quantization step

Transmission buffer sufficient degree

Empty

Full

Usual

Important